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LOUISIANA PEARLSHELL

RECOVERY PLAN

LOUISIANA PEARLSHELL
(Margaritifera hembeli)

Recovery Plan

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for

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Approved:



Regional Director, U. S. Fish and Wildlife Service

Date:

December 3, 1990

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the listed species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species' status, and the completion of recovery tasks.

Literature citation should read as follows:

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EXECUTIVE SUMMARY

Current Status: The Louisiana pearlshell is only known from Bayou Beouf, Rapides Parish, Louisiana. It is restricted to small, clear streams of shallow depth. Populations number from a few individuals to several hundred. They are very susceptible to collecting and predation.

Habitat Requirements and Limiting Factors: Specific habitat requirements are not known. The species apparently requires a free-flowing stream. The removal of beavers and their dams will continue as a protective action. Life history studies and habitat requirements will be determined.

Recovery Objective: To reclassify the Louisiana pearlshell to threatened status.

Recovery Criteria: The Louisiana pearlshell may be reclassified when:

1. populations in each of Long Branch, Bayou Clear, Loving Creek and Little Loving Creek number the greater of 2,000 individuals or the level determined by the Louisiana National Heritage Program survey of 1985, and the habitat in these streams is fully protected and;
2. populations in each of Mack Branch, Castor Creek, Valentine Creek and Brown Creek number in excess of 1,000 individuals, and the habitat is fully protected; and,
3. these minimum levels are maintained for a period of at least 10 years with evidence of successful reproduction and recruitment.

Actions Needed:

1. Protect the known populations and their habitat.
2. Conduct life history research.
3. Determine the feasibility of reintroductions.
4. Monitor population trends.

Total Estimated Cost of Recovery: With practically no information on the life history, population levels, and habitat requirements for this species, an estimate of the cost of recovery to the point of downlisting is not possible. Costs estimated for actions identified in this plan for a 3-year period total \$869,000.

Date of Recovery: With immediate implementation of this recovery plan, this species can be downlisted in 2015.

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PART I: INTRODUCTION

The bivalve mollusks (Unionacea) are generally accepted to be divided into two families, Margaritiferidae and Unionidae. The Margaritiferidae consists of only two genera, Margaritifera and Cumberlandia, and five species in North America. The Margaritiferidae is considered to be the most primitive of the unionids (Ortmann 1912, Heard and Guckert 1970, Davis and Fuller 1981), with an origin as early as the Devonian period some 400 million years ago (Smith 1976) to the Cretaceous period some 60 million years ago (Davis and Fuller 1981). The more primitive species are those with the simplest morphological characters. Margaritifera is considered to have the most primitive morphology of the unionids and is likely very similar to taxa that gave rise to the recent unionids (Davis and Fuller 1981). While there is some disagreement on whether this group should be a distinct family or is a sub-family, there is no disagreement on the standing of this group of mussels as distinct morphologically and immunologically (Davis and Fuller 1981, Smith and Wall 1984).

Description

The Louisiana pearlshell was described as Unio hembeli by Conrad in 1838, then placed in Margaron by Lea (1870), in Margaritana by Simpson (1900), and finally in Margaritifera by Athearn (1970). On February 5, 1988, the U.S. Fish and Wildlife Service (Service) published in the Federal Register a final rulemaking (U.S. Fish and Wildlife Service 1988) indicating its determination that the Louisiana pearlshell is an endangered species under the Endangered Species Act of 1973, as amended.

The Margaritiferidae are considered to be primitive unionids based upon the development of the internal anatomy. The margins of the mantle do not unite or approach each other and therefore do not form brachial or anal siphons. The marsupium is formed by all four gills, and the gills lack watertubes. The diaphragm is incomplete, formed only by the gills (Ortmann 1912, Heard and Guckert 1970, Davis and Fuller 1981). Glochidia are small, semicircular and globular, without hooks (Ortmann 1912).

The shell of the Louisiana pearlshell (Margaritifera hembeli) is oblong with moderately full beaks without obvious sculpture. The posterior ridge is low, the anterior end is rounded and the ventral margin is generally straight or slightly curved. The shell surface has uneven growth lines and occasionally has faint sculpture lines on the posterior end. The epidermis is brown to blackish and the nacre is white to purple with numerous pits. Adults are about 100 millimeters (mm) (3.9 inches) long, 50 mm (2.0 inches) high and 30 mm (1.2 inches) wide. Conrad (1838) described the type specimen as follows: "Shell elliptical, convex, posterior extremity angular, much above the line of the base; posterior slope with obtuse undulations; beaks eroded, scarcely elevated above the dorsal line; umbonal slope undefined; epidermis dark brown, becoming black with age, much wrinkled; within white;

cardinal teeth robust, double in each valve, direct, profoundly striated." The recently described Alabama pearlshell, M. marrianae, differs from the Louisiana pearlshell by having an arcuate ventral margin and elaborate sculpture on the posterior slope and disk (Johnson 1983).

Distribution

The genus Margaritifera occurs in the northern half of both hemispheres (Burch 1975, Davis and Fuller 1981). The Louisiana pearlshell, M. hembeli, is known from only the Bayou Boeuf drainage in Rapides Parish, Louisiana (Figure 1). An extensive search of 39 streams in Rapides Parish by biologists from the Louisiana Natural Heritage Program (LNHP 1985) found the Louisiana pearlshell in 11 streams. Prior to the LNHP search, this species was known from only three streams in the Bayou Boeuf drainage. Since the original survey, the LNHP has discovered an additional population in Valentine Creek, bringing the total known populations to 12.

The LNHP survey found the Louisiana pearlshell scattered in headwater streams of the Bayou Boeuf drainage. This suggests a historic range including most, if not all, of the Bayou Boeuf system. It also suggests that impoundments have eliminated populations in some intervening areas. This suggested historic range of the species is supported by a small population in Brown's Creek of the Bayou Rapides drainage. Bayou Rapides enters the Bayou Boeuf system several miles below any other known population of the Louisiana pearlshell. The occurrence of this species in such an isolated stream indicates access to other populations at some earlier period. Kincaid Reservoir impounds the headwaters of Bayou Boeuf and has isolated small populations of this species in Mack Branch and Valentine Creek, the only known populations above the reservoir. The species is not found above other impoundments of the Bayou Boeuf system but does occur in the unimpounded Caster Creek and Bayou Clear drainages in good numbers. Nearly 90 percent of the populations are found in four streams: Long Branch, Bayou Clear, Loving Creek, and Little Loving Creek (LNHP 1985).

Life History/Ecology

The life history of the Louisiana pearlshell has not been studied beyond a biological and morphological study of museum specimens by Smith (1988). The life history is presumed to be similar to that of other unionids. During the spawning period, males discharge sperm into the water and females collect the sperm by the siphoning process. Eggs are fertilized and held in the females gills where they develop into larvae or glochidia. The glochidia are discharged into the water where they attach to a fish host, become encysted, and metamorphose into juvenile mussels that are capable of surviving if they fall to suitable substrate. Mussels are also dependent upon the water currents to bring food particles within the range of their siphons.



Figure 1. Range of Louisiana Pearlshell

The identity of fish hosts for glochidia of Louisiana pearlshell remain unknown. A study by Hill (1986) identified some potential hosts, however, the glochidia appear to have been unidentifiable. Hill (1986) indicated that the fish hosts for the Louisiana pearlshell may be the striped shiner (Notropis chrysocephalus), the redbfin shiner (N. umbratilis), and the golden shiner (Notemigonus crysoleucas). The study was based upon seining fish from close proximity to beds of the Louisiana pearlshell and then examining the fish for glochidia infections. The three fish species were the only ones collected with encysted glochidia, and based upon literature records of glochidia size and shape and identified fish hosts for other mussel species occurring in the stream, the encysted glochidia were presumed to be Louisiana pearlshells. Two other mussel species (Fusconaia flava and Villosa lienosa) have been collected from the same streams. The fish host for V. lienosa is unknown. A large number of fish species serve as hosts for F. flava. The glochidia figured in Hill (1986) is a Unionidae glochidia rather than a Margaritiferidae and likely from Fusconaia (M. Gordon in litt.; R. Neves, Virginia Tech Univ., pers. comm., 1989). The glochidia of M. margaritifera are somewhat spoonshaped and are less than half the dimensions specified by Hill. The glochidia of M. hembeli should be very similar to those of M. margaritifera. The glochidia photographed by Hill are very similar to those of Fusconaia cuneolus and are semi-elliptical in shape. The glochidia in Hill's report are more like Fusconaia than Margaritifera (Neves pers. comm. 1989). In addition, the period of the year when Hill found encysted glochidia is wrong for Margaritifera. Smith (1988), in a study of museum specimens of M. hembeli, concluded that oviposition of eggs and spawning of males occurs in late November to late December with the release of larvae occurring in late December to January. He concluded there was no evidence to indicate that glochidia were released at any other time of year. The period of glochidial release is very short and makes encystment of this species on fish hosts from March through August very unlikely, if not impossible.

Margaritifera prefer softer, cleaner water and more peculiar substrata than other unionids and are therefore more sensitive to environmental impacts. The Louisiana pearlshell is typically found in flowing water at depths ranging from 30 to 60 centimeters (12-24 inches) on stable sand and gravel substrata. In stream reaches where the substratum is not stable, only adults are found and they often appear to be in stress. Soil in the area drained by Bayou Beouf is low in limestone (Frierson 1927). Darden (1988) found that two streams where the Louisiana pearlshell occurs had a lower total hardness and somewhat more acidic pH than what is recorded for streams where other unionids occur. However, Darden's study is not comprehensive enough to draw conclusions on water quality requirements of the Louisiana pearlshell.

Reasons for Listing

Only three species of freshwater mussels have been recorded from streams where the Louisiana pearlshell occurs. Of these, the Louisiana pearlshell is the most abundant. It is apparent that this species has adapted to this small stream environment and that it is probably very sensitive to adverse

impacts. The existence of this species in several disjunct populations in the Bayou Boeuf drainage is an indication of a much larger historic range, at least in this drainage, and of the probable sensitivity of this species to environmental impacts. We can only speculate about range contraction because there are no records on which to document the probable larger historic range.

Inundation by beaver dams appears to be a significant threat. One population of about 1,000 Louisiana pearlshells found in the 1985 LNHP survey was inundated by a beaver pond. A survey by Service biologists (1986) determined that this particular population had been eliminated. The small localized populations of this species are especially susceptible to beaver impoundments.

Habitat within the Kisatchie National Forest is impacted by silviculture practices and to some extent by cattle grazing under the open range policy. Clearcutting increases erosion and runoff, resulting in increased sedimentation and velocity in the stream. Another major contributor to sedimentation is the construction and maintenance of road crossings in the vicinity of mussel populations. Mussels are not very successful in coping with increased sedimentation and velocity in streams. Sedimentation will smother adults and juveniles with perhaps a greater impact on the juveniles. Increased water velocity has a scouring effect on the substratum and may eliminate entire populations by shifting the substratum and dislodging the mussels. In streams where the Louisiana pearlshell occurs, there is evidence of shifting sand that has dislodged adult mussels. While in distress, the adults seem to be coping with this shifting sand, but no juveniles were found in these areas during the 1986 survey by the Service.

In the Kisatchie National Forest there is an open range policy that permits cattle grazing. These animals use the streams for water and tend to create crossings. Should one of these crossings be at or immediately above a mussel bed, there would be adverse impacts resulting from the increased sedimentation and organic input from the cattle. As mentioned earlier, the Louisiana pearlshell is apparently more sensitive than other unionids to water quality degradation.

Within the Bayou Boeuf drainage there are a number of gravel pits on private lands that contribute to sedimentation, especially in the Indian Creek drainage. As discussed earlier, sedimentation is detrimental to mussels, and this is a possible cause for the absence of the Louisiana pearlshell from the Indian Creek drainage.

This species is not sought by collectors, yet it is very vulnerable to collecting. Its occurrence in very shallow, clear streams and with about 1 inch of the shell protruding from the substratum, makes it very visible. Should an overzealous collector seek this species, an entire population could be eliminated within a few hours. Such impacts could easily reduce the species below viable reproductive levels.

Conservation Measures

The U.S. Forest Service has a beaver control program within the known range of this mussel, is restricting the use of off-road vehicles near known populations, and is reviewing grazing permits to ensure that cattle do not pose a threat to existing mussel beds. The Forest Service approved a Water Resource Inventory Work Plan in 1988 and implemented it in 1989 to collect water quality data on streams where this species is known to occur. Smith (1988) has provided information on the biology and morphology of this species. Darden (1988) has provided some baseline water quality data on selected streams within the Kisatchie National Forest.

PART II: RECOVERY

A. Objective

The objective of this plan is to reclassify the Louisiana pearlshell from endangered to threatened status. The Louisiana pearlshell may be reclassified when:

- (1) populations in each of Long Branch, Bayou Clear, Loving Creek and Little Loving Creek number the greater of 2,000 individuals or the level determined by the LNHP survey of 1985, and the habitat in these streams is fully protected;
- (2) populations in each of Mack Branch, Castor Creek, Valentine Creek and Brown Creek number in excess of 1,000 individuals, and the habitat is fully protected; and,
- (3) these minimum levels are maintained for a period of at least 10 years with evidence of successful reproduction and recruitment.

Fully protected is defined as the implementation of protective measures, such as land management standards and guidelines for mussel habitat management, to ensure populations of this species remain at or greater than the levels specified in the recovery objective. Protection will extend in the watershed, including public and private lands, to the point where activities in the watershed no longer affect the stream.

The time required for the attaining the above objective is estimated to be 25 years. Once this species has been reclassified to the threatened category, criteria for delisting will be developed.

B. Narrative Outline for Recovery Actions Addressing Threats

1. Protect the known populations and their habitats from further impacts. Based on recent surveys, some 90 percent of the individuals occur in four streams, with the total population in only 12 streams. Continued survival and recovery of this species depends upon the protection of all these streams.
 - 1.1 Develop and implement a management plan with the U.S. Forest Service to prevent further decline. Most of the known range of the Louisiana pearlshell is within the Kisatchie National Forest, with small private inholdings on some stretches of individual streams. This task will develop a plan to manage

the forest resources, control beavers, and regulate cattle grazing that will accomplish the objectives of the Forest Service while still protecting this species. Nearly all the populations are on Forest Service lands and will most certainly be extirpated without this task. A population of 1,000 individuals was extirpated by a new beaver dam before the Forest Service began beaver control.

- 1.2 Conduct population surveys. The Louisiana Natural Heritage Program survey provided good baseline data from which population trends can be established. All 12 streams that have the Louisiana pearlshell and any new or reestablished populations will be surveyed at 3-year intervals to establish trends. Other streams within the Bayou Boeuf drainage that may have small populations of this species will be surveyed periodically to determine if the species was overlooked or is expanding its range. Surveys will be conducted by counting individual mussels without removing them from the substratum. Specific areas along each stream where this species exists will be marked for these counts to ensure comparable population data. Development and implementation of the plan in 1.1 is dependent upon this information. This information will also alert us to any sudden declines in the population in time to take corrective actions.
2. Conduct life history research on the species. While protecting adult mussels and their known habitats is mandatory, it is equally important that we know the life history of the species if we are to ensure survival and recovery. This task will determine fish host(s), preferred habitats, water quality requirements, and other life history parameters. Survival is dependent upon protection of all aspects of the life history. For example, loss of the fish host(s) means loss of the mussel.
3. Determine the feasibility of reintroducing the species. The Louisiana pearlshell apparently existed throughout the Bayou Boeuf drainage. To ensure recovery of this species, it will be necessary to reestablish populations in other streams within the drainage.
 - 3.1 Determine the suitability of other Bayou Boeuf tributaries as habitat. This task will gather data on streams where this species occurs and compare them with data on other streams within the drainage in an effort to select streams suitable for reestablishment. Data will be gathered on such variables as substratum type, water flow and depth, water chemistry, presence of fish host(s), presence of associated mussel species, and other pertinent information. Priority will be given to those streams where the species still exists but in very low numbers.

- 3.2 Develop a successful method of establishing new populations.
This task will consider methods of reestablishing mussel populations in order to develop a method that can be used in very small streams. This will include, but not be limited to, the best method of starting a new population (relocating adult mussels or infested fish host(s)), a means of measuring the success of reestablishment, and the time of year to move the mussels or infested fish host(s).
- 3.3 If feasible, introduce species based upon results of 3.1 and 3.2. This task will select one or more streams and implement the necessary tasks for reestablishment of the Louisiana pearlshell.

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PART III: IMPLEMENTATION SCHEDULE

Priorities in column one of the following implementation schedule are assigned as follows:

1. Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
2. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
3. Priority 3 - All other actions necessary to meet the recovery objective.

Key to acronyms used in Implementation Schedule

FWE - Fish and Wildlife Enhancement, U.S. Fish and Wildlife Service
Res. - Division of Research, U.S. Fish and Wildlife Service
LDWF - Louisiana Department of Wildlife and Fisheries
USFS - U.S. Forest Service

IMPLEMENTATION SCHEDULE										
PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION	RESPONSIBLE PARTY			COST ESTIMATES (\$K)			COMMENTS/NOTES
				USFWS		Other	FY 1991	FY 1992	FY 1993	
				Region	Program					
1	1.1	Develop and implement management plan	continuous	4	FWE	LDWF USFS	10	15	15	
1	1.2	Conduct population surveys	continuous	4	FWE	LDWF USFS	3	3	3	
1	2	Life history research	3 years	4	FWE	LDWF USFS	200	200	200	
2	3.1	Feasibility of reintroductions	continuous	4	FWE, Res.	LDWF USFS	30	30	30	
2	3.2	Develop method for reintroductions	2 years	4	FWE, Res.	LDWF USFS	20	20		
2	3.3	Reintroduce species	continuous	4	FWE, Res.	LDWF USFS	30	30	30	

APPENDIX

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